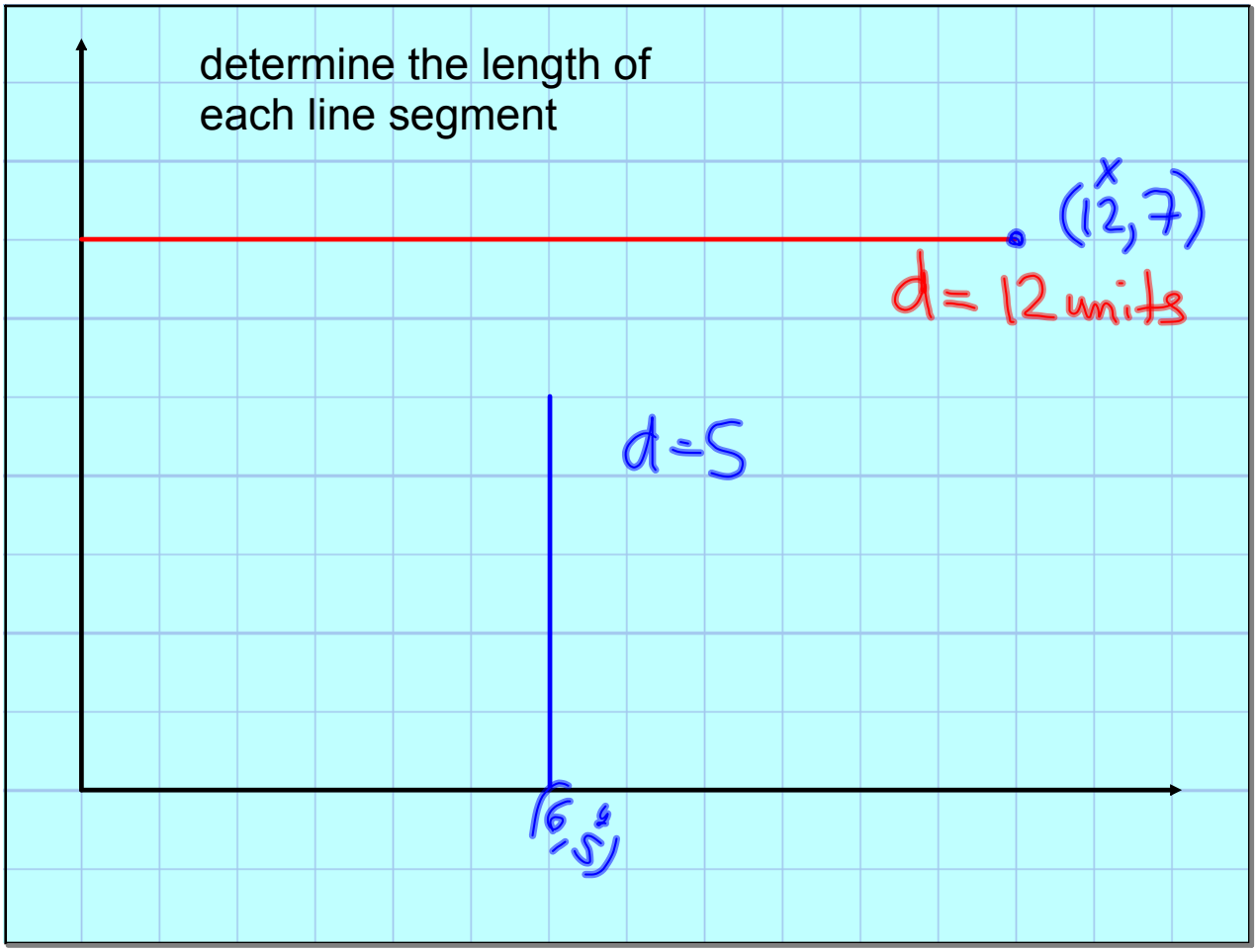
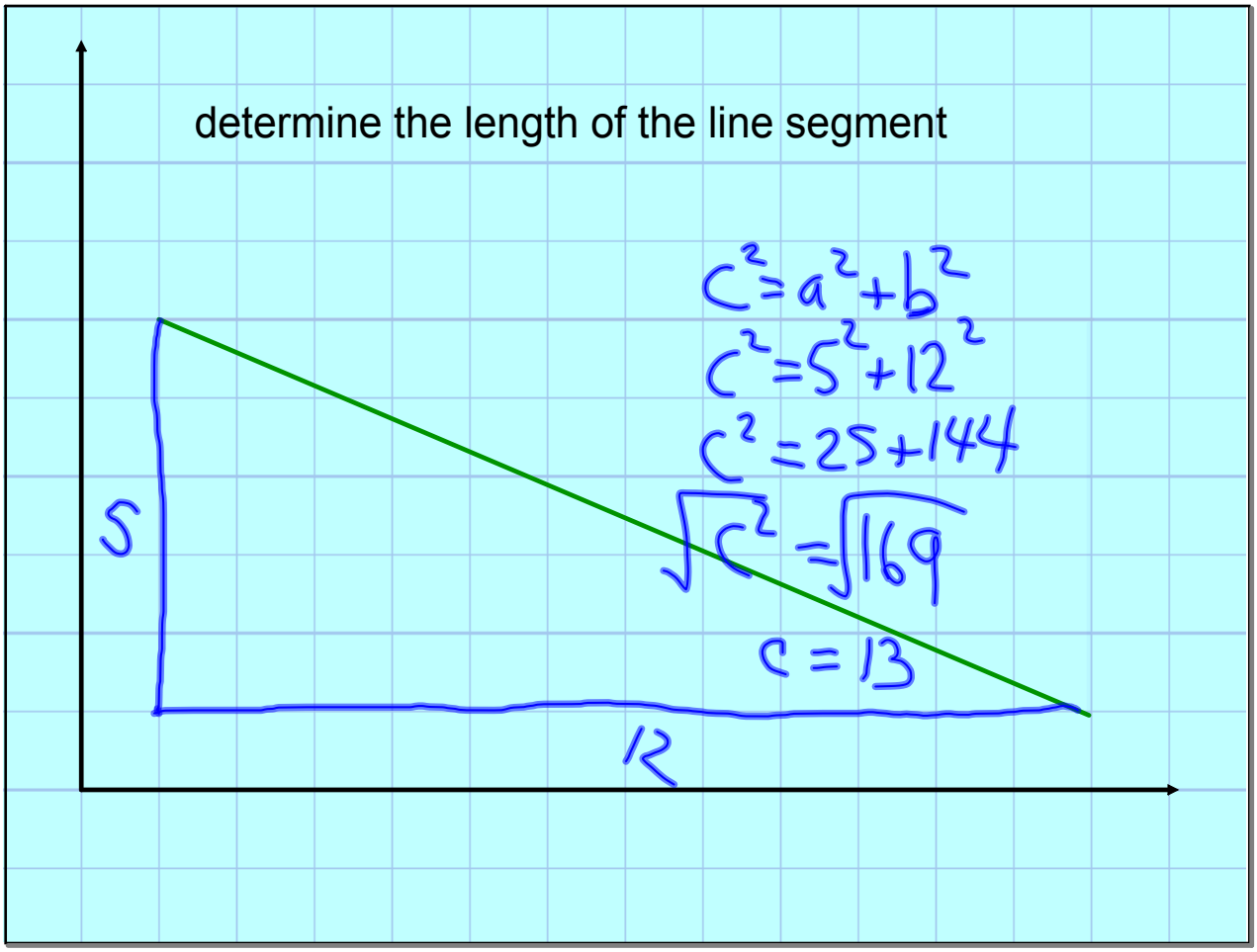
determine the length of each line segment



determine the length of the line segment



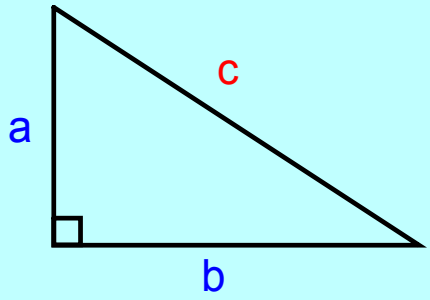
Recall: The Pythagorean theorem (see p.68 to review)

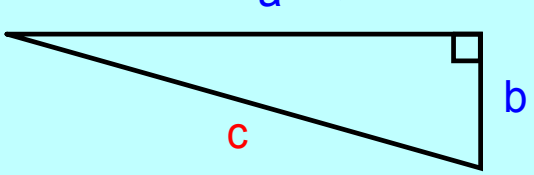
In a right-triangle, $a^2 + b^2 = c^2$, where

c is the hypotenuse
a, b are the other two sides

$b^2 = c^2 - a^2$

$a^2 = c^2 - b^2$





L3(2.2)-Length of a Line Segment

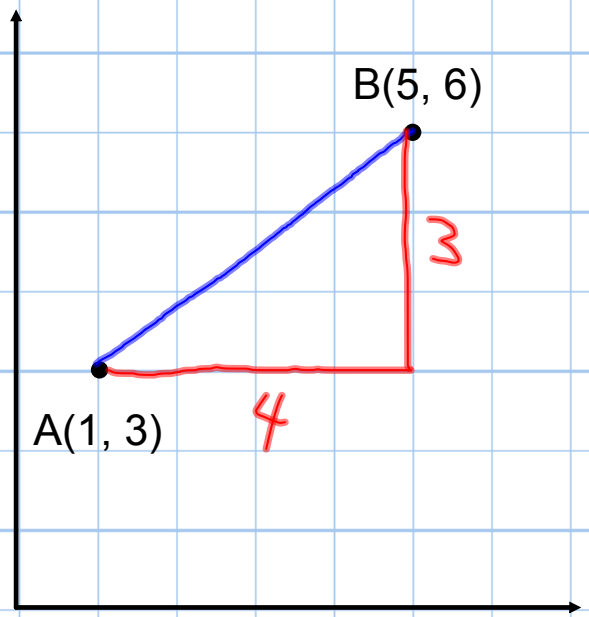
A line segment is a straight line between two points. The length of a line segment can be determined from the coordinates of the two points:

1. Connect the points with a line segment.

2. Construct a right-triangle, where the line segment is the hypotenuse.

3. Use the Pythagorean theorem to find the length of the line segment (hypotenuse).

Ex.1 Determine the length of AB (d_{AB} or $\overline{AB}$)



$c^2 = a^2 + b^2$

$c^2 = 4^2 + 3^2$

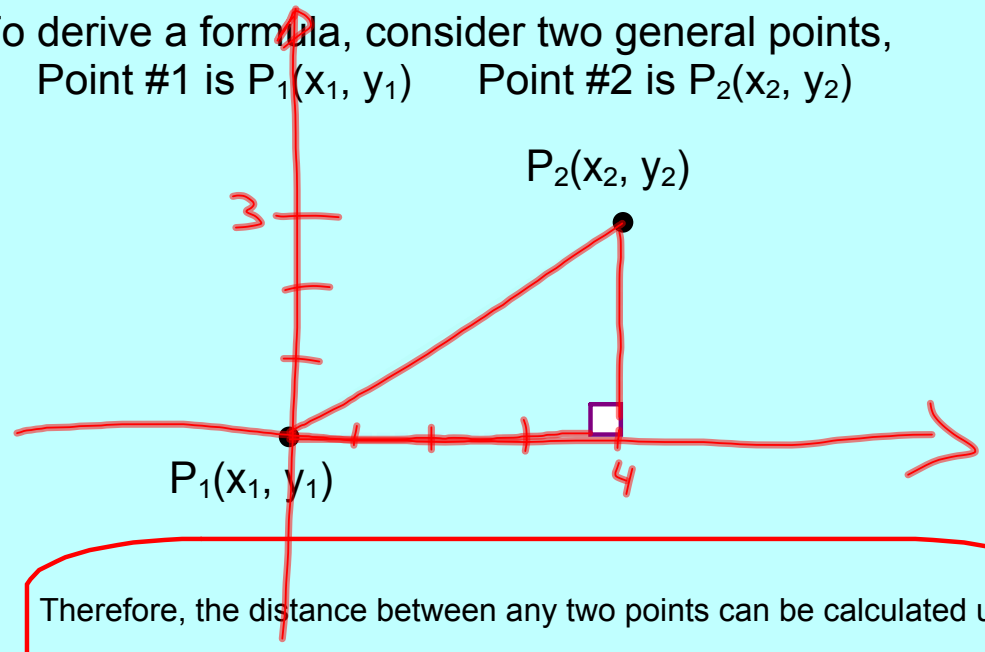
$c^2 = 16 + 9$

$\sqrt{c^2} = \sqrt{25}$

$c = \pm 5$

To derive a formula, consider two general points,

Point #1 is $P_1(x_1, y_1)$ Point #2 is $P_2(x_2, y_2)$



Therefore, the distance between any two points can be calculated using:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Ex.2 What is the distance between the points G(-3,1) and H(4,5)? *Give an exact and approximate answer rounded to the nearest tenth.*

No decimals

$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

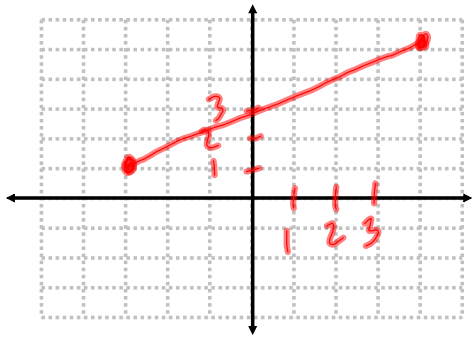
$= \sqrt{(4-(-3))^2+(5-(1))^2}$

$= \sqrt{(7)^2+(4)^2}$

$= \sqrt{49+16}$

$= \sqrt{65}$ exact

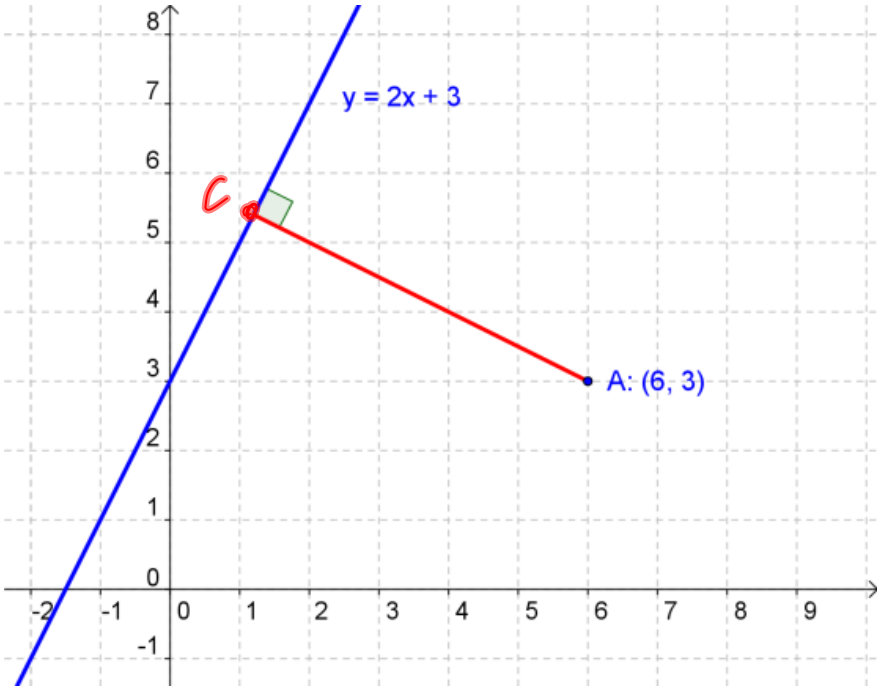
$\doteq 8.1$



$\sqrt{c^2} = \sqrt{a^2+b^2}$

$c = \sqrt{a^2+b^2}$

To determine the distance between a point and a straight line, draw the <u>perpendicular</u> line through the point.



Ex.3 Calculate the distance between the point G(6,-1) and the line y = 3x + 1. *Give an exact and approximate answer rounded to the nearest tenth.*

$m_\perp = -\frac{1}{3}$

$y = -\frac{1}{3}x + b$

Sub (6,-1) to solve b

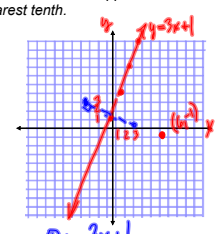
$y = -\frac{1}{3}x + b$

$-1 = -\frac{1}{3}(6) + b$

$-1 = -2 + b$

$2 - 1 = b$

$b = 1$



① $y = 3x + 1$

② $y = -\frac{1}{3}x + 1$

Sub x=0 into ①

$y = 3x + 1$

$y = 3(0) + 1$

$y = 1$

Sub ① into ②

$3x + 1 = -\frac{1}{3}x + 1$

$3x + \frac{1}{3}x = 1 - 1$

$3x + \frac{1}{3}x = 0$

$x = 0$

$\therefore$ the POI is $(0,1)$

(x_1, y_1) $(6,-1)$ & $(0,1)$ (x_2, y_2) solve distance

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$d = \sqrt{(0-6)^2 + (1-(-1))^2}$

$= \sqrt{36 + 4}$

$= \sqrt{40}$ exact

$\doteq 6.3$ approx.

Assigned Work: p.86-87 # 1ac, 4cd, 6, 7(draw), 12ab, 15